REMARKS

Claims 1-22 are pending in this application.

Claims 1-22 are rejected.

In the office action dated December 4, 2002 and made final, claims 1-6 and 10-11 are rejected under 35 USC §103(a) as being unpatentable over Parkin U.S. Patent No. 5,966,012 in view of Lin U.S. Patent No. 5,949,623. This rejection is respectfully traversed.

Claim 1 recites a magnetic memory device comprising a data layer having a magnetization that can be oriented in first and second directions; and an unpinned synthetic ferrimagnet reference layer.

Parkin does not teach or suggest unpinned reference layers. At col. 6, lines 1+ Parkin discloses a reference layer 118 having a magnetization that is fixed by an AF pinning layer 116, and a sensing layer 132 atop the reference layer 118.

The examiner contends that columns 1-2 of Parkin suggest a reference layer that can be pinned or unpinned, but contradicts himself later on page 3 of the office action, when he states that "Parkin et al. do not necessarily disclose said synthetic ferrimagnet reference layer to be unpinned."

The undersigned has reviewed columns 1-2 as well as the remainder of Parkin, and has not found a teaching or suggestion of an upinned reference layer. If the examiner maintains the '102 rejection, he is respectfully requested to cite the column and line numbers in the next office action.

Lin et al. do not teach or suggest an unpinned synthetic ferrimagnet reference layer. Lin et al. discloses anisotropic magnetoresistive (AMR) and giant magnetoresistive (GMR) sensors including a sense layer and reference layer separated by a non-magnetic spacer layer. Although Lin et al. primarily disclose reference layers having pinned magnetizations, they do mention at col. 1, lines 36-38 that the reference layer of an AMR device may generate a transverse bias field by activation from the current supplied to the sensor.

However, Lin et al. do not disclose a structure for generating a current-activated bias field, let alone a synthetic ferrimagnet in such a structure. Moreover, Lin et al. do not provide a reason, incentive or motivation for eliminating the pinning layer from Parkin's tunneling magnetoresistive (TMR) device. They simply state that the reference layer of an AMR device may generate a transverse bias field by activation from the current supplied to the sensor.

The office action states that that "it is understood in the art of magnetic resonance that reference layers can generate the required traverse bias field a generic function for all reference layers in all types of magnetic resonance sensors in the prior art as cited, either by being pinned or by the activation from the current supplied by the sensor for sensing the data layer's resistance, thus obviating the need for the additional energy expanded for the pinning (motivation)."

If the statement is taken at face value, it is irrelevant. Claim 1 recites a magnetic memory device, not a magnetic resonance sensor.

However, It appears that this statement is derived from Lin et al., even though the office action does not say so. If the statement was indeed derived from Lin et al., then the office action goes well beyond the teachings of Lin et al.

The office action appears to state that a transverse bias function is a generic function for all reference layers, and that the motivation for current activation in any magnetoresistive device is to obviate the need for additional energy expended for the pinning. These statements do not appear in Lin et al.

Therefore, it is presumed that these statements are based on the personal knowledge of the examiner. The examiner is respectfully requested, pursuant to MPEP §707 and 37 CFR §1.104(d)(2), to cite a document or affidavit supporting his personal knowledge that "it is understood in the art of magnetic resonance that reference layers ... expanded for the pinning (motivation)," whether for magnetic resonance devices or magnetoresistive devices.

The combination of Parkin and Lin do not teach or suggest the magnetic memory device of claim 1. Therefore, claim 1 and its dependent claims 2-6 and 9-12 should be allowed over the combination of Parkin and Lin.

Claims 7-8 are rejected under 35 USC §103(a) as being unpatentable over Parkin U.S. Patent No. 5,966,012 in view of Dahlberg et al. U.S. Patent No. 6,166,539. This rejection is respectfully traversed.

Claim 7 recites a magnetic memory device including a data layer, and a synthetic ferrimagnet reference layer, the data and reference layers having different coercivities. Claim 7 further recites a first conductor on the reference layer; an electrical insulator on the first conductor; and a second conductor on the insulator. The second conductor may be used to set the magnetization orientation of the reference layer during read operations.

The office action states that Parkin shows first and second layers of conductors 102 and 112. According to col. 5, lines 66+ of Parkin, a seed layer

112 is formed on an electric conductor 102. The seed layer 112 is used to establish a crystal orientation for the overlying pinning layer 116. The passage does not teach or suggest a layer between the seed layer 112 and the conductor 102, and Figure 4a of Parkin does not show any layer between layers 102 and 112.

Moreover, there is no reason, incentive, or motivation to place an insulator between the layers 102 and 112 of Parkin's device. Parkin discloses a TMR device. During a read operation, through-plane resistance of the TMR device is measured, that is, resistance is measured between conductor 102 and a top electrical lead 104. Placing an insulator between layers 102 and 112 would prevent the through-plane resistance from being measured.

Dahlberg et al. do not disclose a TMR device. They do not offer a reason, motivation or incentive for placing an insulator between the layers 102 and 112 of Parkin's TMR device. Therefore, claim 7 and its dependent claim 8 should be allowed over Parkin and Dahlberg et al.

Claims 18 and 20-22 are rejected under 35 USC §103(a) as being unpatentable over the combination of Parkin, Lin, Monsma and Gallagher. This rejection is respectfully traversed.

Claim 18 has been amended to correct a typographical error. Replacement claim 18 recites an information storage device comprising an array of memory cells, each memory cell including a data layer and a soft ferrimagnet reference layer, the data and reference layers having magnetizations that can be switched between first and second directions during write operations, only the reference layer being switchable between first and second directions during read operations.

As discussed above, neither Parkin nor Lin teach or suggest a synthetic ferrimagnet reference layer that is switchable between first and second directions.

Neither do Gallagher et al. or Monsma. Gallagher et al. disclose an AF pinning layer 18 for their reference layer at col. 4, line 20.

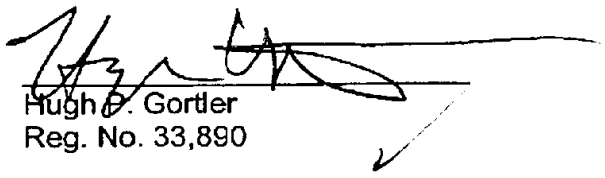
Monsma et al. disclose a device 50 including a lower pinned ferromagnetic layer 51 and a tunnel junction 52. The tunnel junction 52 is assumed to have a conventional structure, such as that disclosed on col. 2, lines 61+. The conventional structure includes an antiferromagnetic pinning layer 15 (see col. 2, line 65).

Thus the combination of Parkin, Lin et al., Monsma and Gallagher et al. do not teach or suggest the information storage device of claim 18. Therefore, claim 18 and its dependent claims 19-22 should be allowed over the combination of Parkin, Lin et al., Monsma and Gallagher et al.

Claim 8 has been amended to depend properly from claim 7. The examiner is thanked for pointing out the improper dependency of original claim 8.

The Examiner is respectfully requested to withdraw the rejections and issue a notice of allowability. If any issues remain, the Examiner is invited to contact the undersigned.

Respectfully submitted,



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Date: February 3, 2003

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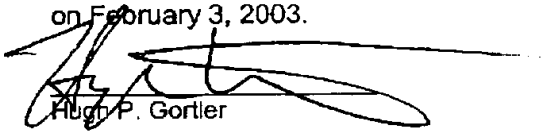

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VERSION WITH MARKINGS TO SHOW CHANGES MADE

8. The device of claim 7, further comprising a third conductor in contact with the ~~second~~ data layer, the third conductor being orthogonal to the first conductor.

18. An information storage device comprising an array of memory cells, each memory cell including a data layer and a soft ferrimagnet reference layer, the data and reference layers having magnetizations that can be switched between first and second directions during write operations, only the ~~second~~ reference layer being switchable between first and second directions during read operations.